Robust expansion and Hamiltonian cycles in k-partite graphs

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Chen, Faudree, Gould, Jacobson, and Lesniak determined the minimum degree threshold for which a balanced k-partite graph has a Hamiltonian cycle. We give an asymptotically tight minimum degree condition for Hamiltonian cycles in arbitrary k-partite graphs (in which all parts necessarily have at most $n/2$ vertices). To do this, we first prove a general result which simplifies the process of checking whether a graph is a robust expander. Then we use this result to prove that any k-partite graph satisfying the minimum degree condition is either a robust expander or else contains a Hamiltonian cycle directly.

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